eye on environment

NETL Using EPCA Survey Results for Federal Lands Access

Energy Policy and Conservation Act

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This Edition of Eye on Environment features Federal Lands access research.

Federal Lands comprise about 262 million acres of surface land and 700 million acres of subsurface mineral estate (**Figure 1**). Most of the public lands that the Bureau of Land Management (BLM) oversees are located in the 11 states of the Far West plus Alaska.

These lands are rich in energy resources. Production from onshore Federal Lands accounts for 11% of the Nation's natural gas production and 5% of its oil production. Under the U.S. Energy Policy and Conservation Act (EPCA), the Secretaries of the Interior and Energy departments must undertake a national inventory of onshore oil and natural gas reserves. The ultimate goal of such a survey is to help expedite access to oil and gas resources on Federal Lands while minimizing environmental impacts.

Working through Advanced Resources International Inc., Arlington, VA, NETL is studying the impacts of Federal Lands environmental stipulations to determine which ones pose the greatest restrictions to oil and gas development. NETL will focus its research on finding economical approaches to furnishing the protection that each stipulation is designed to provide, while allowing oil and gas development to proceed.

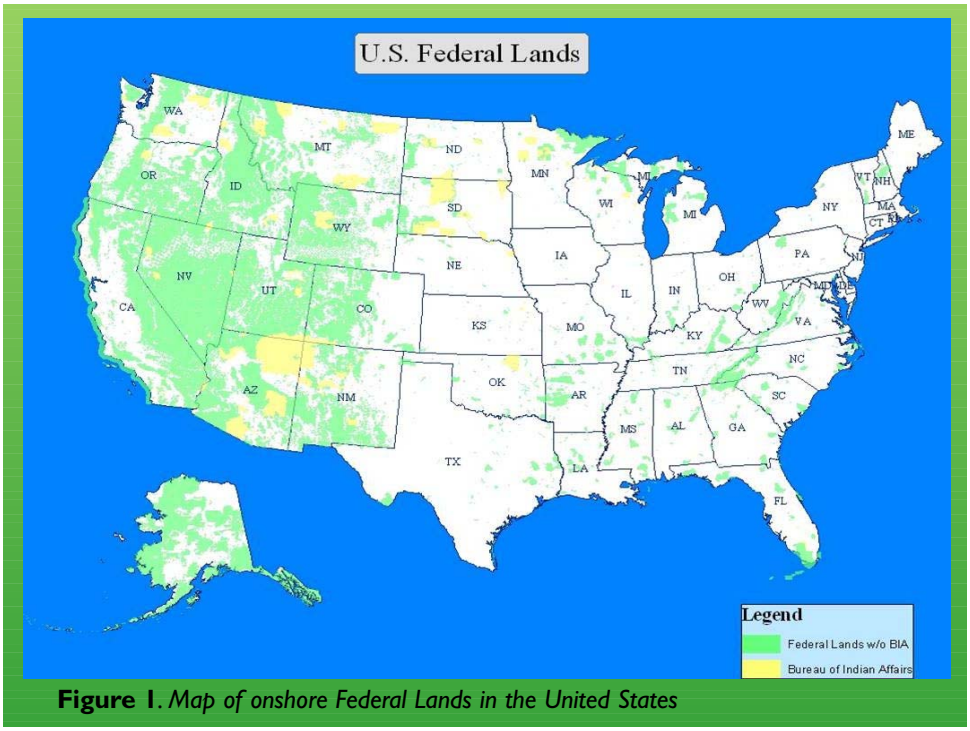

Figure 1. *Map of onshore Federal Lands in the United States*

FEDERAL LANDS INVENTORY

The Department of Energy participated with BLM in the research and analysis for Phase I of the EPCA survey, concluded in January 2003.

Phase I covers the basins and areas with the greatest volumes of recoverable oil and gas reserves underlying onshore Federal Lands: an estimated 7 trillion cubic feet equivalent (TCFE) of natural gas and oil. DOE also assisted in evaluating and planning R&D activities related to Federal Lands access for the Phase II study, soon to be released by BLM.

The EPCA inventory of oil and gas reserves on Federal Lands is designed to provide estimates of undiscovered, technically recoverable resources and proved reserves. The survey characterized U.S. geographical basins by the amount of recoverable oil and gas reserves only on Federal Lands in these areas. The Interior West focus, Phase I, contains most of the natural gas and oil resources on Federal and State Lands in the five regions studied. The subsequent Phases II, III, and IV reports will address oil and gas reserves in basins with significantly smaller reserves or less Federal Lands. The basins containing the largest volumes of reserves on Federal Lands break out as:

Phase I
Uinta-Piceance Basin (Colorado and Utah).
Paradox-San Juan Basin (Colorado, New Mexico, and Utah).
Montana Thrust Belt (Montana).
Powder River Basin (Montana, Wyoming, South Dakota, and Nebraska).
Greater Green River Basin (Colorado, Utah, and Wyoming).

Phase II
Northern Alaska (ANWR and NPR-A).
Wyoming Thrust Belt (Wyoming, Idaho, and Utah).
Denver Basin (Colorado, Wyoming, South Dakota, and Nebraska).
Florida Peninsula (Florida).
Black Warrior Basin (Mississippi and Alabama).
Appalachian Basin (New York, Pennsylvania, New Jersey, Ohio, West Virginia, Virginia, Maryland, Tennessee, and Kentucky).
The Williston Basin (North Dakota, South Dakota, and Montana), Big Horn Basin (Wyoming), and Wind River Basin were not part of the EPCA dataset but were examined as an analog to the study.

The undiscovered, technically recoverable resources underlying onshore Federal Lands in the Lower 48 states are placed at 5.5 billion bbl of total liquids and 183 TCF of natural gas. New estimates were made for reserves growth and proved reserves, based on 2002 data used in the EPCA Phase I report. The Phase I report estimates indicate that more oil and gas is recovered from fields as development occurs than was booked as proved reserves at the time of discovery. Proved reserves in 1,255 Phase I fields categorized under Standard Lease Terms totaled 428.6 million barrels of oil, or 53% of all U.S. proved oil reserves on Lower 48 onshore Federal Lands. Natural gas reserves were estimated at 26 TCF, or 60% of the Lower 48 Federal Lands onshore total.

FEDERAL LANDS ACCESS

Some of the most significant development in onshore oil, gas, and particularly coalbed natural gas plays are located in the Phase I and II regions in the Rocky Mountain states. The Powder River Basin in Montana and Wyoming and the San Juan Basin are very active plays, but further development has been impeded by limited or slow access to Federal Lands. The operator of the newest "discovery" oil play in the Rocky Mountains, the Convenant Field play in south-central Utah, recently announced that Federal Lands access stipulations and the required Environmental Impact Statements will hold back expansion of the play by as much as 2 years. DOE's research on stipulations identifies approaches that will work in all basins to reduce adverse impacts, protect the environment, and promote increased oil and gas production.

The main thrust of the analysis for Phase I were the access limitations that restrict drilling on Federal Lands. The Phase I EPCA study found that under

leasing stipulations for Federal Lands, 11% of natural gas reserves were on leases closed to development. Leases with restrictions contain 26% of Phase I natural gas reserves. The remaining 63% of natural gas reserves are on leases with standard lease terms. Leasing stipulations for Federal Lands for oil result in 15% of reserves closed to leasing. Leases with restrictions contain 28% of oil reserves, and 57% of oil leases have standard lease terms (**Figures 2 and 3**).

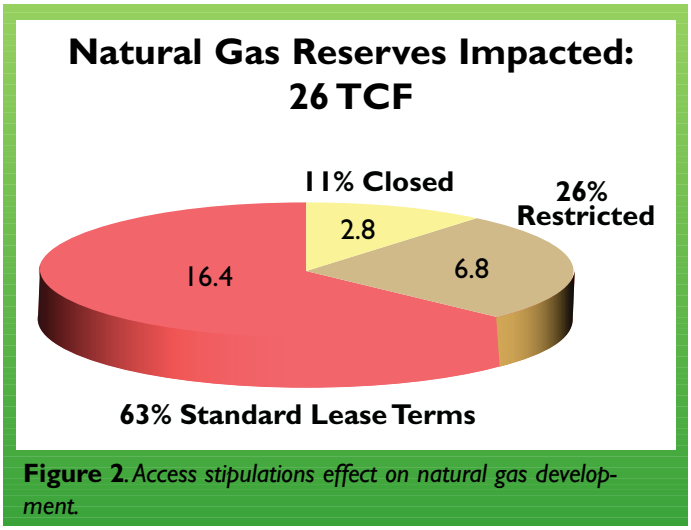

Figure 2. *Access stipulations effect on natural gas development.*

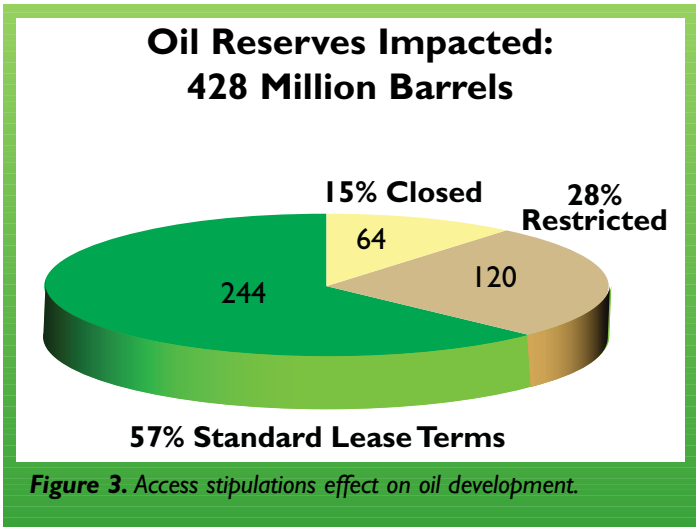

Figure 3. *Access stipulations effect on oil development.*

Oil and gas leases are governed by statutory and regulatory requirements. These requirements are multipurpose, mainly involving protection of environmental, social, historical, or cultural resources or values. The EPCA Inventory concentrated on the analysis of constraints to oil and gas development based on two primary factors:

- Whether the lands are open or closed to leasing
- The degree of constraint to development resulting from lease stipulations on open lands.

DOE had two primary objectives for the analytical portion of the EPCA analysis:

- To develop analyses of stipulations having large impacts on Federal Lands access and oil and gas resource development. This information will assist DOE in evaluating the effect of its R&D activities on addressing the stipulations with the goal of improving access with minimal environmental impact.
- To identify and assess current data gaps within the EPCA datasets. The goal is to determine how to improve the analytical ability to address Federal Lands access, including future environmental and cultural considerations.

LEASING CATEGORIES

Nine leasing categories or levels were established in EPCA Phase I based on the time element of leasing limitations. Analysis for Phase II modified the levels by adding limitations (**Table 1**). The limitations were studied as a function of drilling depth relating to oil and gas resources that are too deep to drill within a single season.

Table 1. Modified EPCA Access Categories

1. No Leasing (Statutory/Executive Order)
2. No Leasing (Administrative)
3. No Leasing (Administrative) Pending Land Use Planning or NEPA Compliance
4. Leasing, Net No Surface Occupancy
5. Leasing, Cumulative Timing Limitations of >9 months, Drill Depth Limited

5a. Leasing, Cumulative Timing Limitations of >9 months

6. Leasing, Cumulative Timing Limitations of >6 to <9 months, Drill Depth Limited

6a. Leasing, Cumulative Timing Limitations of >6 to <9 months

7. Leasing, Cumulative Timing Limitations of >3 to <6 months, Drill Depth Limited

7a Leasing, Cumulative Timing Limitations of >3 to <6 months

8. Leasing, Cumulative Timing Limitations of <3 months, Drill Depth Limited or Controlled Surface Use

8a. Leasing, Cumulative Timing Limitations of <3 months or C Controlled Surface Use

9. Leasing, Standard Lease Terms

In terms of access, Categories 1-4 are Inaccessible, while Categories 5-8 are Accessible with Restrictions. Federal Lands in Category 9 are Accessible under Standard Lease Terms or with Minimal Restrictions.

STIPULATION TYPES

There are 10 types of stipulations governing Federal Lands access for oil and gas operations:

- Areas of cultural/historic resources.
- Areas of high aesthetic value.
- Big game habitat.
- Hazardous geology/steep slopes.
- Hydrologic resources.
- Other wildlife habitat.
- Raptors/accipitor habitat.
- Recreation emphasis.
- Sage and sharp-tailed grouse habitat.
- Threatened, endangered, or special-status species habitat.

Within the oil and gas producing region of the Rocky Mountains, areas that fall under stipulations include a range of historic sites such as the Little Bighorn Battle National Monument, MT (**Figure 4**).

Figure 4. *View of Little Bighorn National Monument from Last Stand Hill, Powder River Basin, MT.*

Areas that fall under the class of high aesthetic value and hazardous geology include parts of the San Juan Basin in Utah and Colorado (**Figure 5**). The study did not include these areas of high aesthetic value or historical significance in the model because the majority of these areas fall into controlled surface use designation, which puts them under the control of other Federal agencies.

Figure 5. *Rugged terrain of the San Juan Basin*

Four stipulation types were the main thrust of the research:

- **Big game habitat**, which includes species that are largely managed for hunting. These species include white-tailed deer, pronghorn antelope, elk, and mule deer. The specific habitat areas evaluated were winter range, summer range, birthing, and calving areas.
- **Sage and sharp-tailed grouse habitat (Figure 6),** which includes areas critical for nesting, fledgling,

Figure 6. *Male sage grouse strutting on breeding lek in the Powder River Basin, WY.*

and mating. These areas are designated to include ¼ to ½ mile radius from the center of the nesting or primary activity.

• **Hazardous geology/steep slopes**, which includes areas of unstable geologic formation, sensitive soils, areas of critical environmental concern, and areas with slopes greater that 20%. These areas are protected due to the high potential for environmental damage that could result from mechanical disturbance.

• **Other wildlife habitat**, which includes areas that are critical to the survival of wildlife species other than those in the first two categories. Common species include grizzly bear, mountain plover, wild trout, bats, black-footed ferrets and prairie dogs. Certain areas that are designated for threatened, endangered, or special status species are excluded from this category.

STIPULATIONS' IMPACTS

Stipulations on land access and use are essentially the restrictions placed by regulatory agencies that administer the Federal Lands. The EPCA model allows one to strip away portions of a stipulation to determine the environmental effects of that stipulation's absence.

The analysis performed for DOE by ARI covered the five basins in Phase I plus the Wyoming Thrust Belt and Denver Basin from Phase II. For each basin the stipulations were ranked according to their impact on oil and gas activities in that particular region. Big game habitat ranked highest for five of the seven basins studied. In the Powder River Basin sage and sharp-tailed grouse habitat displaced big game habitat as the most significant stipulation. In the Montana Thrust Belt, hazardous geology/steep slopes was the most significant stipulation, followed by non-big-game wildlife habitat. **Table 2** gives a breakdown of the stipulation types and the resource impacted for each stipulation type within the individual basins. Due to habitat preferences related to differences in topography and climate, species of big game, grouse, raptors (eagles and hawks), and non-game species are not all found within a specific region or basin.

STIPULATION TYPE	BCFE*
Uinta Piceance Basin	
Big game habitat	3,295
Hazardous geology/steep slopes	1,499
Hydrologic resources	764
Areas of high aesthetic value	559
Other wildlife habitat	524
Paradox-San Juan Basins	
Big game habitat	5,689
Areas of cultural/historic resources	1,283
Hydrologic resources	604
Hazardous geology/steep slopes	410
Recreation emphasis	234
Montana Thrust Belt	
Hazardous geology/steep slopes	1,801
Other wildlife habitat	1,596
Big game habitat	1,254
Recreation emphasis	1,169
Areas of high aesthetic value	844
Powder River Basin	
Sage and sharp-tailed grouse habitat	1,528
Big game habitat	827
Hazardous geology/steep slopes	559
Areas of high aesthetic value	257
Wyoming Thrust Belt	
Big game habitat	239
Hazardous geology/steep slopes	97
Sage and sharp-tailed grouse habitat	57
Hydrologic resources	46
Areas of cultural/historic resources	34
Greater Green River Basin	
Big game habitat	17,676
Sage and sharp-tailed grouse habitat	15,555
Areas of high aesthetic value	4,925
Other wildlife habitat	4,851
Hazardous geology/steep slopes	4,001
Denver Basin	
Big game habitat	51
Areas of high aesthetic value	34
Hazardous geology/steep slopes	11
Raptor/accipitor habitat	6
Threatened, endangered, or special status species	6

***Table 2**. Stipulation types ranked by resource impact within basins. **Billion cubic feet of gas equivalent.*

Stipulations for big game habitat, sage and sharp-tailed grouse habitat, hazardous geology/steep slopes, and other wildlife habitat were analyzed for each basin. Scenarios for each basin were developed based on stipulation impacts of 10%, 20% or 30%. The overall results show that big game winter range (**Figure 7**) is the most significant stipulation type, in terms of billion cubic feet of natural gas equivalent (BCFE) impacted. Sage grouse and raptor habitats tied for second place, followed by hazardous geology/steep slopes, and other wildlife habitat.

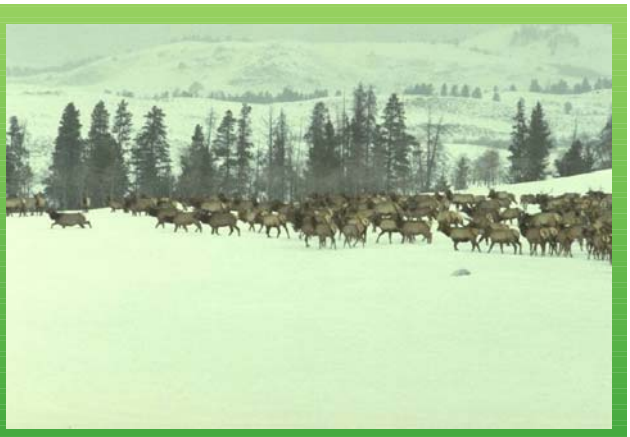

***Figure 7**. Winter range for herds of elk is a significant restriction in basins in Wyoming and Montana.*

One of the problems in assessing the stipulations was the absence of big game and raptor data for some specific geographic areas. Between the EPCA Phase I and Phase II reports, 21,30 stipulations or restrictions were identified and analyzed dealing with issues of missing data. Detailed GIS maps were not available for a significant number (39% of the 2,130 stipulations) of environmental resources within the basins. The inventory concentrated on specific stipulations and environmental resource types where data gaps existed, and selected a finite number for which surrogate data on impacts could be generated and assessed in the EPCA model. Criteria used in the model to assess missing data included the number of occurrences of a stipulation, importance of the leasing level category, the number of field offices affected, an understanding of how the stipulations relate to high-category resources (such as grizzly bear habitat in Wilderness Areas), and an estimation of the area that the stipulation covered. The EPCA study areas were evaluated, and the most important stipulations were ranked (**Table 3**).

The study found that the most common stipulations missing GIS data involved species of big game and raptors. State wildlife agencies were able to supply much of the needed information on big game for the EPCA model. Missing raptor data was supplemented by data from the USGS and state wildlife agencies in Montana, Colorado, Utah, and Wyoming. Raptor species evaluated included osprey, bald eagle, golden eagle (**Figure 8**), merlin, Northern goshawk, peregrine falcon, Swainson's hawk, and Mexican spotted owl. The stipulations were on areas that impacted either the breeding range or the wintering range of the birds.

Table 3 Evaluation of Data Gaps

EPCA Study area	Stipulated Environmental Resource
Uinta Piceance Basin	Raptors and sensitive species
Paradox/San Juan Basins	Aesthetic/historic/cultural areas and raptors
Montana Thrust Belt	Big game, raptors, and historic/cultural/heritage areas
Powder River Basin	Raptors and sage grouse
Wyoming Thrust Belt	Big game and raptors
Greater Green River Basin	Big game and raptors
Denver Basin	Raptors and sensitive species

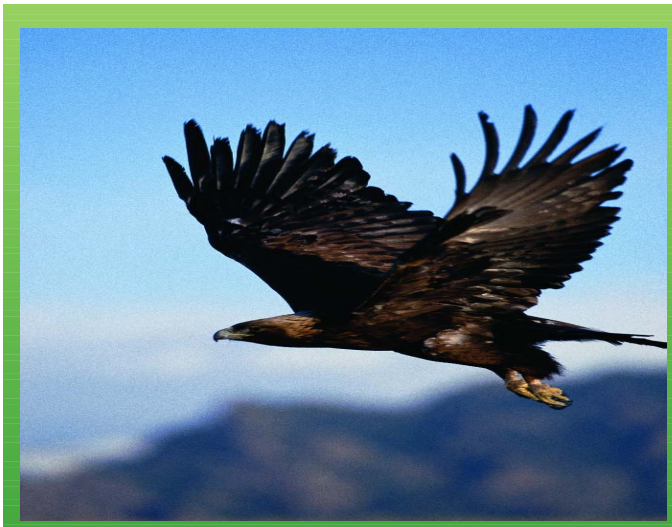

***Figure 8**. The magnificent golden eagle is a common raptor in Rocky Mountain basins.*

Data for the three analog basins—Williston, Big Horn, and Wind River—were based on 1995 USGS National Oil and Gas Assessment figures and fit into the Modified EPCA Access Categories. The Williston Basin contains 11% Federal Land with 329 BCFE of hydrocarbon resources impacted by stipulations. The Big Horn Basin has 68% Federal Land with 307 BCFE impacted. The Wind River Basin is 51% Federal Land and contains 514 BCFE of impacted hydrocarbon resources.

The three scenarios analyzed were based on 10%, 20%, or 30% random impact on the oil and gas resource. The timing limitation for the 10% scenario was 2 weeks' duration, and the impact was judged to be modest. For the 20% scenario, the timing was 4 weeks, and the impact would be significant. In the third scenario (30%), the timing was 6 weeks, which would result in a very significant impact.

One of the advantages of the EPCA model is its ability to look at the simultaneous effects of several stipulations. The model can show the degree of improvement that would result if significant changes were made to geography and timing limitations for big game, sage grouse, and raptor stipulation under each of the three scenarios.

RESULTS

The EPCA model can address questions such as: "Is the combined impact greater than the sum of the individual impacts, and if so, by how much?" For Scenario 2 (20%) the impacts for big game, sage grouse and raptors are 7, 3.5, and 3.3 TCFE, respectively. In the integrated, or combined, analysis the impact increases to 14.5 TCFE, or more than the sum of the individual impacts.

The EPCA model shows that the impact of stipulation types for resource assessment for the Greater Green River and Powder River basins are significantly larger than results based on earlier USGS data. The current analysis indicates that the impact is 3½ times greater for the Greater Green River Basin and 2 times greater for the Wind River Basin than indicated in previous studies.

For all the stipulation types and for all the basins the results of the EPCA modeling indicate that restrictions on big game winter range (**Figure 9**) have the most significant impact on oil and gas development activities. Sage grouse and raptor habitats are tied for second place followed by hazardous geology/steep slopes and other wildlife-habitat. The model allows for beneficial resource-shifting to assess how the stipulation type may impact development.

Figure 9. *Bighorn sheep winter on the slopes of the Rocky Mountains.*

The results for all basins show that aggregated resource-shifting out of Modified EPCA Access categories 5 through 8 into categories 8a (Timing Limitations of <3 months) and 9 (Standard Lease Terms) can be accomplished with improved knowledge of the stipulations and their effect.

CONCLUSIONS

The study found that each of the Rocky Mountain basins is unique in relationship to stipulation types. Big game winter range dominates in the basins. In the southern basins raptor habitat is significant; however, this changes to sage grouse habitat in the northern basins. Geohazards/steep slopes have a significant effect but are typically integrated with other, lower-order stipulations, particularly timing issues.

The analysis implies that significant impacts could be made for various stipulation types if non-environmentally compromising changes are made to stipulation geography, timing, or exception rates. Targeted, productive R&D to address these stipulations has the opportunity to provide significant access to oil and gas resources in the Rocky Mountain basins. As much as 7 TCFE of oil and gas resources can become accessible for the Nation's use.

Calendar of Events 2005/2006

2005

Oct. 9-12
SPE, *Annual Technical Conference & Exhibition*, Dallas, TX.
Contact: **www.spe.org.**

Oct. 24-26
IPAA, *Annual Meeting*, Houston, TX.
Contact: **www.ipaa.org/meetings.**

Nov. 8-11
IPEC, *International Petroleum Environmental Conference*, Houston, TX.
Contact: **ipec.utulsa.edu**.

2006

Feb 7-8
NAPE, *North American Prospect Exposition*, Houston, TX.
Contact: **nape@landman.org.**

Feb 7-8
IADC, *Health, Safety, Environment & Training Conference & Exhibition*, Houston, TX.
Contact: **www.iadc.org.**

Feb. 21-23
IADC/SPE, *Drilling Conference*, Miami, FL.
Contact: **www.iadc.org.**

Mar. 8
IADC, *Spring Meeting*, Houston, TX.
Contact: **www.iadc.org**.

Apr. 9-12
AAPG, *Annual Convention*, Houston, TX.
Contact: **www.aapg.org.**

Apr. 22-26
SPE/DOE, *Improved Oil Recovery Symposium*, Tulsa, OK.
Contact: **www.ior2006.org**.

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